Atl Econ J (2007) 35:279–288
DOI 10.1007/s11293-007-9076-8

Supporting the Endogenous Relationship Between Well-Being and Employment for US Individuals

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Published online: 11 July 2007

Abstract We test the existence of an endogenous relationship between well-being and employment for US individuals. To that end, we use a simultaneous equation generalized Probit model applied to four recent waves of the National Health Interview Survey (1997–2000). Our results do not enable us to accept the hypothesis that there is a significant effect from employment status to subjective well-being. In contrast, we provide evidence that suggest that well-being is positively correlated to the probability of having a job.

Keywords Well-being · Employment · Endogeneity

JEL Classification I30 · J21

Introduction

A central point of the literature on labour economics is the relationship between employment status and subjective well-being or mental health. The effect of having a job on mental health is not a trivial one. Taking the well-known labour supply model as a general theoretical framework, well-being and employment are closely related. For example, as Hamilton et al. (1997, p. 398) stated, "Then labour supply and labour demand factors together affect the equilibrium level of mental health and employment observed in the market." Different hypotheses have been established in the psychological and economic literature for this relationship, recognizing in most cases that this relationship goes in both directions, that is, employment can affect personal well-being but also well-being is a determinant for getting a job.

Psychologists agree that being employed has beneficial mental health effects or, in others words, losing employment reduces well-being.[1] Some authors argue that

[1]For a summary of the psychological literature on these effects, see Darity and Goldsmith (1996).

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even people that could manage economically without working might prefer to be employed. Shields and Wailoo (2002, p. 447) point out that other aspects as well as the loss of income are also important: "Having a job also provides a structure to the day gives a sense of purpose and fosters networks of social interaction." But at the same time, employment can have negative effects on well-being. Firstly, after controlling for income, the model of work-leisure choice suggests that unemployment and, therefore, more leisure, increases utility at a given income. Secondly, employment may increase stress, which may reduce mental health.

It is also clear that well-being can affect employment status. For example, sociologists point out that more optimistic people have more probability of finding a job, given the individual's ability to influence events (Fryer 1986). Moreover, other authors suggest that people with mental health problems will have more days off sick, reducing the probability of finding and maintaining their jobs.

Focusing on specific results, although a prolific literature has concluded that unemployment represents a significant and negative determinant in the well-being of individuals (Clark and Oswald 1994, 1996; Gerlach and Stephan 1996; Gerdtham and Johannesson 1997; Korpi 1997; Theodossiou 1998; Winkelmann and Winkelmann 1998; Flatau et al. 2000; Clark et al. 2001; Ravallion and Lokshin 2001). Korpi (1997, pp. 126-127) has pointed out that the analysis of the relationship between mental health and employment status is not an easy task as there is a possibility of non-random selection and unobserved heterogeneity. Most importantly, he argues that apparently only two other works have incorporated unobserved heterogeneity to date (Björklund 1985; Edin 1988) and neither of them have found a causal effect of unemployment on well-being.

In this line, Korpi (1997) and other authors have incorporated unobserved heterogeneity into the model when analysing the relationship between well-being and employment status. In general, they have used a longitudinal model in which they have assumed the existence of an individual fixed effect that is time invariant. Most of these researchers have found a negative and significant relationship between unemployment and subjective well-being (Korpi 1997; Winkelmann and Winkelmann 1998). However, a few of them have not found a robust effect from unemployment to well-being (Björklund 1985; Edin 1988; Ravallion and Lokshin 2001).

We agree with Korpi (1997, p. 143) when he points out that further attempts to control unobserved heterogeneity are needed and so we propose a simultaneous equation model in which the two variables of central interest, that is to say, well-being and employment status, are determined simultaneously allowing the possibility of a bi-directional casualty and, thus, controlling for unobserved heterogeneity. This model, discussed in Amemiya (1978) and called the simultaneous equation generalized Probit model, has been applied with data from Canada by Hamilton et al. (1997), and they show that there is an endogenous relationship between well-being and employment and confirm that well-being affects the probability of being employed and, simultaneously, employment has a significant effect on individual well-being.

In this paper, we present what is, to the best of our knowledge, the first empirical application of a simultaneous equation generalised Probit model with US data. We use four recent waves of the National Health Interview System (1997–2000). By contrast with the data set used in Hamilton et al. (1997), that is to say, Montreal data

from 1985–1987, our US data does not suffer from sample selection problems, and so we do not have to take them into account in order to obtain consistent estimations. Another original aspect of this paper is that our well-being variable is constructed in such a way that it includes the degree to which the feeling of well-being affects the daily activity of individuals, in the sense that it is relatively oriented towards various stress-related symptoms.

The rest of the paper is organised as follows. The second section is devoted to presenting the dataset used in this paper, as well as to explaining the empirical model we use to approximate the relationship between well-being and employment status. The most important results of the analysis are considered in the third section, whilst the fourth section closes the paper with a review of the main conclusions.

Data and the Model

With the aim of estimating the relationship between well-being and employment, we used a sample of 23,680 US individuals obtained from the four waves of the National Health Interview Survey–NHIS (Sample Adult), corresponding to 1997, 1998, 1999, and 2000. The well-being variable has been measured by way of an index which incorporates several mental health characteristics.[2] We should note that our well-being index is relatively oriented towards various stress-related symptoms and, as a consequence, our results may be slightly different from those reported in other studies that characterise mental health in strictly medical terms.

Table 1 contains the definitions, as well as the mean of the variables which capture the personal and socio-economic environment of the sample. In addition to standard demographic variables, such as *gender* and *age*, we have included other socio-economic aspects, namely, level of studies (*studies level*), the existence of some physical limitation (*limited*), civil status (*married, divorced, widowed*), the size of the town where the individual lives (*population*), how near they are to their desired weight (*desired weight*), three time dummy variables, some identifying variables, such as the frequency of practising sports (*moderate activity*), a variable which measures the mean of the well-being indicator for each region (*well-being %*), relative income expressed as the differential between the income and the mean of the corresponding region (*income differential*) and, finally, a variable which measures the mean of the employment variable for each region (*employment*).

Given the theoretical framework discussed in the Introduction, that is to say, the labour supply model and the potential endogeneity of the well-being and unemployment variables (Hamilton et al. 1997), we formulate the following

[2]The well-being index has been constructed following a two-step method. In the first, we have aggregated the responses to the following sample questions: "During the last 30 days, how often did you feel sad, nervous, restless, hopeless, as if everything requires a great effort, and worthless, respectively?," with the possible responses being 1: all the time, 2: most of the time, 3: some of the time, 4: a little of the time, and 5: none of the time. Secondly, we have weighted this aggregated value by the response to the question "How much did the latter feeling (sad, nervous, restless, hopeless, as if everything requires a great effort, and worthless) interfere in your daily activities?," which takes the following values 1: a lot, 2: somewhat, 3: a little, and 4: not at all. In this way, our index not only takes into account the existence of psychological problems, but also considers the degree to which these feelings affect daily activity.

Table 1 Variable definitions

Variable	Definition	Mean (standard deviation)
Well-being	Index which measures the individual's well-being, taking values from 0 to 130	66.356 (30.048)
Employment	This takes the value 1 if the individual has a job and 0 otherwise	0.697 (0.460)
Gender	This takes the value 1 if the individual is male and 0 if female	0.432 (0.495)
Age 20	This takes the value 1 if the individual is less than 25 years old and 0 otherwise	0.103 (0.304)
Age 30	This takes the value 1 if the individual is between 25 and 34 years old and 0 otherwise	0.200 (0.400)
Age 40	This takes the value 1 if the individual is between 35 and 44 years old and 0 otherwise	0.217 (0.412)
Age 50	This takes the value 1 if the individual is between 45 and 54 years old and 0 otherwise	0.169 (0.375)
Age 60	This takes the value 1 if the individual is between 55 and 64 years old and 0 otherwise	0.116 (0.321)
Age 70	This takes the value 1 if the individual is between 65 and 74 years old and 0 otherwise	0.103 (0.304)
Limited	This takes the value 1 if the individual is limited in any way and 0 otherwise	0.340 (0.487)
Studies level	This takes values according to the individual's level of studies (1, if the individual has grades between 1 and 11, no diploma; 2, if he/she has high school graduation, a college degree, or a vocational or academic program degree; and 3, if he/she has a bachelor, master, or doctoral degree)	2.005 (0.653)
Married	This takes the value 1 if the individual is currently married and 0 otherwise	0.531 (0.499)
Divorced	This takes the value 1 if the individual is divorced at this moment in time and 0 otherwise	0.158 (0.365)
Widowed	This takes the value 1 if the individual is widowed and 0 otherwise	0.106 (0.307)
Population	This takes values according to the number of inhabitants in the city (0.25, under 250,000; 0.375, between 250,000–499,999; 0.75, between 500,000–999,999; 1.75, between 1 and 2.49 million; 3.75, between 2.5 and 5 million; 5, more than 5 million)	2.056 (1.724)
Desired weight	This takes values according to the individual's present body weight over the desired weight (1, 10% or more below desired; 2, between 5–9% below; 3, between 4.9% below and 4.9% above; 4, between 5–9.9% above; 5, between 10–19.9% above; 6, between 20–29.9% above; 7, 30% or more above)	4.551 (1.938)
Moderate activity	This takes values according to the frequency with which the individual does moderate physical activity for 10 min or more per week	2.208 (3.389)
Well-being %	This measures the mean of the well-being variable in the corresponding region: Northeast, Midwest, South, and West	66.599 (0.073)
Income differential	This measures the difference between the income of the individual and the regional mean	0.000 (0.697)
Employment %	This measures the mean of the employment variable in the corresponding region: Northeast, Midwest, South, and West	0.697 (2.143)

simultaneous equation generalized Probit model which allows us to empirically consider this endogeneity.

$$WB = \gamma_1 EM* + \beta_1 X_1 + \varepsilon_1 \tag{1.1}$$

$$EM* = \gamma_2 WB + \beta_2 X_2 + \varepsilon_2 \tag{1.2}$$

where *WB* measures the subjective well-being and *EM** is a non-observable latent variable whose sign indicates whether or not the individual has a job. Furthermore, (γ_1, β_1, γ_2, β_2) is the vector of coefficients, X_1 and X_2 include the exogenous variables and, finally, we assume that the error terms, ε_1 and ε_2, are correlated and distributed following a bivariate normal distribution. We observe both the well-being variable and a binary variable, *EM*:

$$\begin{cases} EM = 1 & if\ EM* > 0 \\ EM = 0 & otherwise \end{cases}$$

Solving the above system for *WB* and *EM**, and modifying the notation slightly in order to distinguish between variables which appear in the well-being equation, in the employment equation, or in both, we obtain the following reduced form:

$$WB = \left[\left(\gamma_1\beta'_{21} + \beta_{12}\right)X_{12} + \beta'_{11}X_{11} + \gamma_1\beta'_{22}X_{22} + \gamma_1\varepsilon_2 + \varepsilon_1\right]/(1 - \gamma_1\gamma_2) = X\Pi_1 + v_1 \tag{2.1}$$

$$EM* = \left[\left(\gamma_2\beta'_{12} + \beta_{21}\right)X_{12} + \gamma_2\beta'_{11}X_{11} + \beta'_{22}X_{22} + \gamma_2\varepsilon_1 + \varepsilon_2\right]/(1 - \gamma_1\gamma_2) = X\Pi_2 + v_2 \tag{2.2}$$

where X_{12} includes the explanatory variables which affect both equations, X_{11} is the vector of explanatory variables corresponding to the well-being equation, X_{22} is the vector of explanatory variables solely for the employment equation, β_{11} is the vector of coefficients associated with X_{11} in the well-being equation, β_{12} is the vector of coefficients associated with X_{12} in the first equation, β_{21} is the vector of coefficients associated with X_{12} in the employment equation, and, finally, β_{22} is the vector of coefficients associated with X_{22} in the same equation.

Given the joint normality of v_1 and v_2, we have $v_2 = \rho v_1 + \xi$, where $\rho = \frac{\sigma_{12}}{\sigma_1^2\sigma_2^2} = \sigma_{12}$, and following Amemiya (1978), we can express the reduced form in the following way:

$$WB = X\Pi_1 + v_1 \tag{3.1}$$

$$EM* = X\Pi + \rho WB + \xi \tag{3.2}$$

where $\Pi = \Pi_2 - \rho\Pi_1$ Given that the new error ξ is independent of v_1, we can express the likelihood function as:

$$L = \Pi\left[f(WB)P(EM* > 0)^{EM}P(EM* < 0)^{1-EM}\right] \tag{4}$$

that is to say,

$$\log L = \sum_i \log f(WB) + \sum_i (1 - EM_i) \log\left(1 - F\left(X_i' \Pi + \rho\, WB\right)\right) \quad (5)$$
$$+ \sum_i EM_i \log F\left(X_i' \Pi + \rho\, WB\right)$$

where f and F are the normal density function of $N\left(0, \sigma_1^2\right)$ and the standard normal distribution function, respectively. It is important to point out that we express the Π parameters directly as a function of the structural parameters so, when we estimate this model by maximum likelihood, that is to say, both equations simultaneously, we obtain the structural parameters directly, that is to say, without obtaining the reduced parameters.

Empirical Results

Table 2 contains the maximum likelihood estimations. The first column shows the estimated coefficients for the well-being equation, whilst the second presents the estimations for employment status. The first result that we can highlight is a positive correlation coefficient, statistically significant, although its magnitude is very low. Thus, the sign and significance obtained for parameter ρ, suggest the existence of unobserved heterogeneity affecting well-being and employment in the same direction.[3]

With reference to the principal objective of this work, we find that there is a significant and positive effect of well-being on the probability of being employed, that is to say, people who have better mental health have a greater probability of finding a job. In contrast, the employment coefficient is not significant at 95%. A possible explanation for this result is that, as we have pointed out in the "Introduction", there are different forces driving the influence of the employment status of the individual on the subjective well-being. Thus, having a job improves the self-esteem of the individual, increases his income and provides an environment that facilitates social networks. On the other hand, having a job can also produce some stressful situations. Moreover, after controlling for income, labour-supply models predict that more leisure time increases utility. In this context, our results are in line with other authors, such as Björklund (1985), Edin (1988), or Ravallion and Lokshin (2001) who do not find a robust effect of employment on well-being.

However, these results are not completely in agreement with those found by Hamilton et al. (1997) as they found a bi-directional casualty. In other words, although they also found that a higher index of well-being is associated with a higher probability of being employed, they obtained that having a job significantly improves well-being.

This divergence of results could have different causes. The well-being indicator is different in both works. Moreover, as Ravallion and Lokshin (2001, p. 337) suggest,

[3]It should be noted that this coefficient ρ captures the correlation between v_1 and v_2 associated with Eqs. 2.1 and 2.2.

Table 2 Maximum likelihood estimations

Coefficients	Well-being	Employment
Employment	0.354	–
	(0.098)	–
Well-being	–	0.111***
	–	(19.019)
Intercept	61.278***	−12.616***
	(4.109)	(−11.947)
Gender	0.978	−0.333
	(0.931)	(−1.495)
Age20	−10.062	3.789***
	(−0.990)	(27.366)
Age30	−11.106	3.830***
	(−1.126)	(29.553)
Age40	−11.539	3.667***
	(−1.274)	(28.922)
Age50	−11.437	3.386***
	(−1.423)	(26.906)
Age60	−8.146	2.501***
	(−1.338)	(20.539)
Age70	−2.150	0.879***
	(−0.832)	(7.612)
Limited	−11.959***	0.878***
	(−6.915)	(9.875)
Studies level	2.787***	−0.109**
	(3.398)	(−2.269)
T98	0.008	−0.019
	(0.016)	(−0.321)
T99	−15.740***	1.714***
	(−27.058)	(15.315)
T00	−0.383	0.033
	(−0.787)	(0.554)
Married	1.964**	−0.383***
	(2.445)	(−5.796)
Divorced	−2.308**	0.464***
	(−2.297)	(6.174)
Widowed	−1.610*	0.145
	(−1.888)	(1.414)
Population	−0.168	−0.005
	(−1.207)	(−0.370)
Desired weight	0.163*	−0.010
	(1.640)	(−0.870)
Moderate activity	0.126**	–
	(2.132)	–
Well-being %	0.350**	–
	(2.151)	–
Income differential	0.986**	–
	(2.367)	–
Employment %	–	3.284**
	–	(2.187)
Correlation coefficient	0.005***	
	(12.495)	
LR test of joint significance χ^2 (45)	14,978.6***	

t-statistics in parentheses, *significant at the 10% level, **significant at the 5% level, ***significant at the 1% level.

mood variability is a factor in self-rated welfare and responses are related with changes in the economic environment. Secondly, and more importantly, the problem of identification could play an important role. We think that we have solved this problem more plausibly. None of the identifying variables included by Hamilton et al. (1997) in the employment equation is significant at the 95% confidence interval. However, all of our identification variables are clearly significant in both equations at the 95% confidence interval.[4]

Furthermore, we think that our exclusion restrictions in order to identify the model are more plausible. Focusing on the variables that are not similar, the *well-being %* is obviously exogenous as the well-being of the individual can not affect in a perceptible way the well-being proportion of thousands of people. However, there is no doubt that individuals who share a similar environment could be affected by the same meteorological, cultural, or social conditions, which have an effect on perceived well-being. So we have a plausible exogenous variable that influences mental health and does not exert a considerable, if any, effect on employment status. We could present a similar argument for the *income differential* variable. In this respect, Ravallion and Lokshin (2001, p. 336) wrote: "It has been argued that it may in fact be relative income-relative to some reference group-that drives self-rated welfare, rather than absolute income. This is the now classic interpretation ..." At the same time, as most people live from their salaries, it is the job which determines the income and not the income which determines the probability of having a job.

Turning now to the personal and socio-economic environment, our results indicate that the gender variable does not have a significant coefficient in either equation. Focusing on the age variables, we do not find any significant relationship between them and well-being. On this point, we differ from some other authors that have found that satisfaction is U-shaped in age (Clark and Oswald 1994) or find an inverse relationship (Winkelmann and Winkelmann 1998). As regards the probability of being employed, this increases with age with a peak near 30 years old. With respect to the level of studies, our results appear to confirm that those who have achieved a higher level will enjoy a lower probability of suffering from psychological disorders, although the proportion of individuals with a job is lower in this group. However, the magnitude of the coefficient in the employment equation is low compared to other significant variables. Estimates also show that being physically limited reduces well-being considerably.

A surprising result is the significance and magnitude of the temporal dummy variable for 1999. In a simple descriptive analysis of subjective mental health, we have observed the following means: 68.740, 69.659, 55.219, and 69.505 for the years 1997, 1998, 1999, and 2000, respectively. So, the descriptive analysis shows that the well-being reported is very similar for every year except 1999 when the mean is much lower (the result captured in the model). However, this is very difficult to explain in terms of economic indicators as there are no significant differences in the growth of the GDP or unemployment rate.

[4]We have obtained the same bi_directional casualty between the two endogenous variables, as Hamilton et al. (1997), only when using non-significant identifying variables in the equations. However, we consider that the significance of the identifying variables is crucial for obtaining consistent results.

The family situation also appears to affect both well-being and employment. Estimations indicate that the level of well-being is higher among married people and lower among divorced people. These effects have a similar quantitative impact on the level of well-being but in the opposite direction.

Nevertheless, these variables have opposite signs in the employment equation, so that married people have a lower probability of being employed, while people whose marriage has ended in divorce have a higher probability. The third variable relative to the familiar situation takes into account whether the person is widowed. This variable appears as significant in the well-being equation but only at the 90% confidence level. The estimated coefficient shows that becoming a widow(er) has a negative impact on the mental health level. This impact is less powerful than the effect of divorce, its coefficient being about 70% of the divorced variable. This could be due to the fact that in most cases, widowhood occurs at the end of life and is assumed as an inevitable fact. In contrast, to get divorced could be considered as being unsuccessful in the family.

Other common variables which appear in other works, such as *population* and *desire weight*, do not appear as significant. Finally, we have introduced a number of variables into the estimation in order to identify both equations. Although we have discussed their plausibility before, we now briefly discuss their estimates. First of all, we find that all of them are significant at the 95% confidence level and have the expected signs, which provides more support for our identification strategy. We can conclude that people who practise moderate activity enjoy high levels of mental health. Furthermore, living in regions where people have better well-being has a positive impact on subjective well-being. This result provides evidence of the importance of the environment of the individual, such as the social safety network which conditions his subjective situation. In addition to this, the higher the levels of income people have in comparison to their neighbours in the region, the better the subjective well-being they enjoy. Finally, the identifying variable included in the second equation shows that living in a region with higher rates of employment significantly increases the possibility of having a job.

Conclusions

In this study, we have used a simultaneous equation generalized Probit model to test the endogenous relationship between the individuals' index of well-being and their employment situation. This model has been estimated using four waves of the National Health Interview Survey (NHIS) corresponding to 1997, 1998, 1999, and 2000. This model is welcome as most of the literature has used fixed effects models, and, so, it provides an alternative way of modelling sample selection and unobserved heterogeneity.

The main result is that we have not found evidence of a robust effect of employment on well-being. In contrast, we provide evidence that a better state of well-being increases the probability of employment. In the light of this, it would appear that policies aimed at improving the well-being of unemployed people could also have the effect of improving employment. In relation with this point, it is necessary to make it clear that we are testing whether there are differences in well-being between people who work and people who do not work, independently of whether they want to work or not.

With reference to the socio-demographic variables, the results are according to expectations. To be married increases subjective mental health; to become widowed or divorced reduces well-being. Furthermore, relative income exerts a positive impact on subjective welfare.

Finally, the results also suggest the existence of social effects, such as the fact that those living in areas with a higher well-being will benefit from this and report higher levels of subjective well-being. This characteristic would amplify the effects of policies aimed at improving the mental health of the individual. Moreover, such policies, by improving the well-being of the population, would contribute to increasing their employability.

Acknowledgements The authors would like to express their gratitude to an anonymous referee for his/her helpful comments on a previous version of the paper. We also thank the "Instituto de Salud Carlos III" (Spanish Ministry of Health and Consumption) for their financial support under project number PI021501. The usual disclaimers apply.

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